

BENDIX VACUUM POWER SERVICE MANUAL

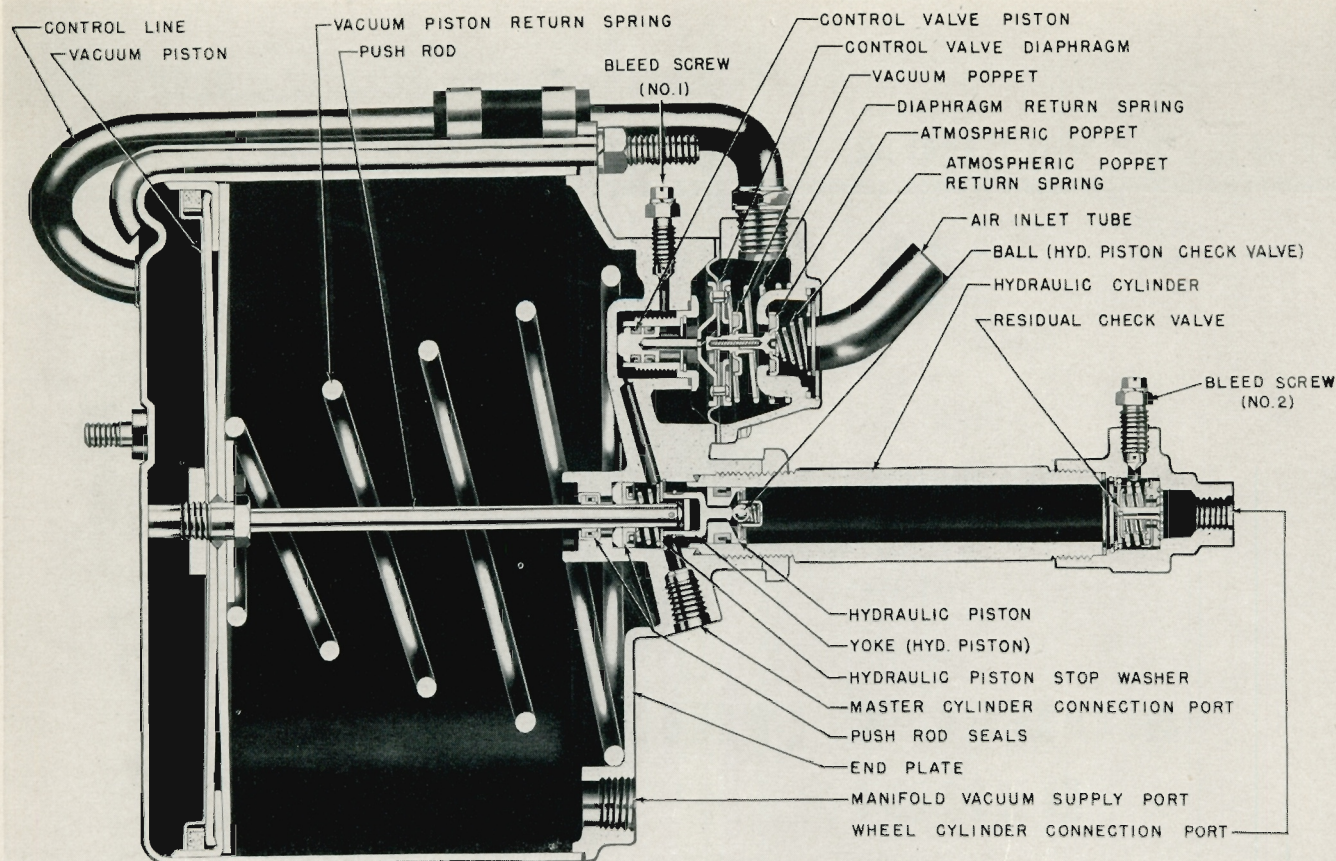


MODEL C (THIRD SERIES) BENDIX HYDROVAC

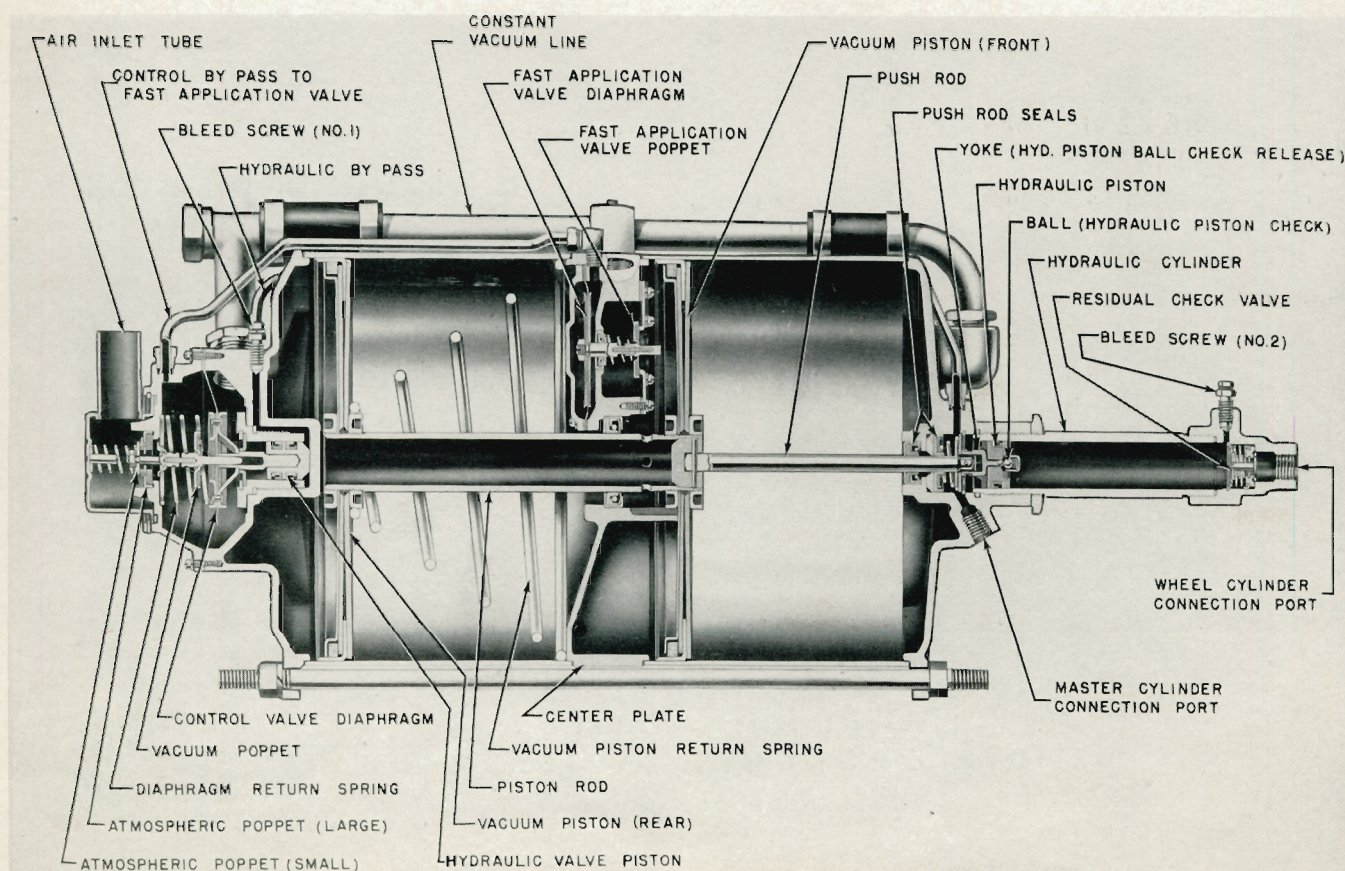
- **PRINCIPLES OF OPERATION**
- **BLEEDING THE SYSTEM**
- **IDENTIFICATION OF UNITS**
- **BENCH OVERHAUL**

**SERVICE SALES DEPARTMENT
BENDIX PRODUCTS DIVISION OF
SOUTH BEND 20, INDIANA**





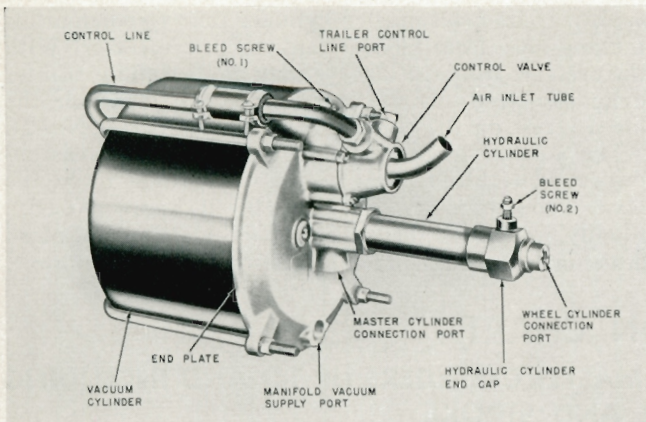
Sectional view of single piston Hydrovac with principal parts identified



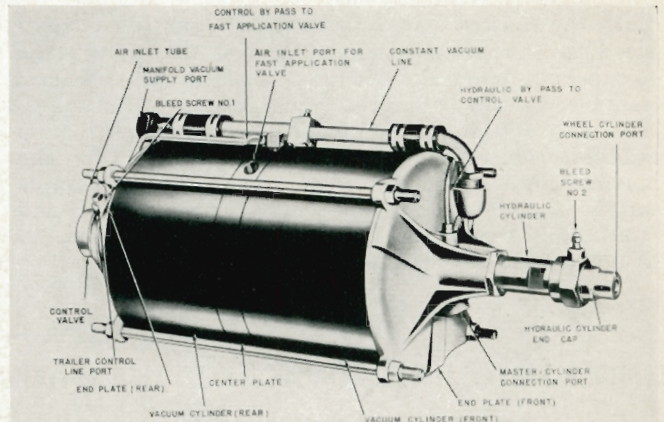
Sectional view of tandem piston Hydrovac. Unit illustrated has fast-application valve

BENDIX HYDROVAC SERVICE MANUAL

MODEL C (THIRD SERIES) PRINCIPLES OF OPERATION



Single piston Model C Hydrovac



Tandem piston Model C Hydrovac

The Hydrovac consists of three basic units which have been so combined that they function as a single unit, all of which are controlled by hydraulic pressure developed within the master cylinder of the vehicle. The three basic units are:

1. A hydraulically actuated vacuum control valve which controls the degree of brake application or release. The control valve consists of a hydraulic actuated piston, a diaphragm, and a vacuum and an atmospheric poppet.
2. A vacuum power cylinder which contains either a single or tandem piston and a push-rod that connects the vacuum piston to the hydraulic piston of the hydraulic cylinder.
3. A hydraulic cylinder which contains a piston with a check valve. Some models also incorporate a residual line pressure check valve.

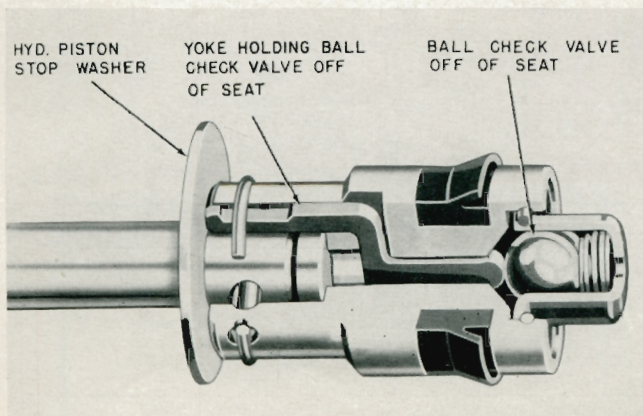
As the brake pedal is depressed, the hydraulic pressure developed within the master cylinder is transmitted to the hydraulic piston of the control valve and to the

hydraulic cylinder. With pressure applied to the control valve piston, the vacuum valve closes and the atmospheric valve opens to admit air to control side of the vacuum power cylinder. As air is admitted, the forces acting upon the vacuum power cylinder pistons are transmitted directly to the hydraulic piston through the push-rod. As the hydraulic piston starts to move, the piston check valve closes trapping fluid under pressure ahead of the piston.

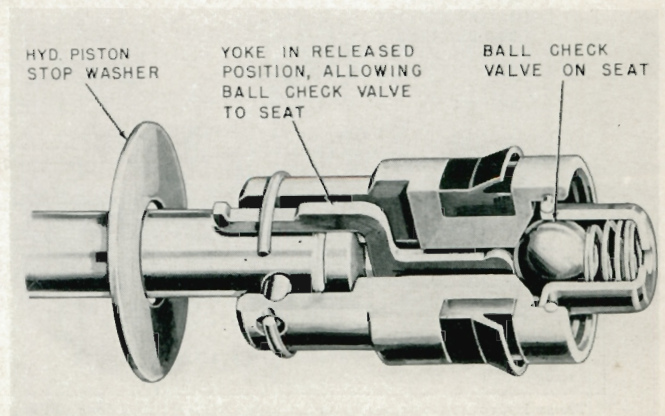
The total hydraulic pressure created and transmitted to the wheel cylinders, is the sum of the pressure developed as a result of the vacuum power cylinder push-rod thrust and the pressure received by the Hydrovac from the master cylinder.

As the brake pedal is released, the pressure within the control valve hydraulic piston chamber is reduced, allowing the atmospheric poppet to close and reopen the vacuum poppet. The vacuum power cylinder piston is again balanced in vacuum and returns to release position. When the hydraulic piston nears the release end of its stroke, its check valve reopens, thus permitting the full release of the brakes.

HYDRAULIC PISTON CHECK VALVE OPERATION



Hydraulic check valve in released position



Hydraulic check valve in applied position

BLEEDING MODEL "C" HYDROVAC ON THE VEHICLE

Manual Bleeding

Manual bleeding requires filling the master cylinder reservoir and pumping the brake pedal to force the fluid through lines to expel air from the system. *Caution:* This operation must be done with the engine *off* and no vacuum in the power brake system.

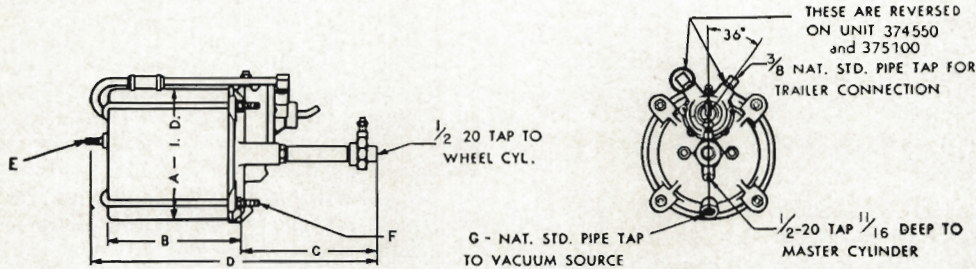
With the master cylinder reservoir filled, open No. 1 bleed screw on Hydrovac and depress the brake pedal to expel air. When the pedal has reached the toe board, *close* bleed screw before returning pedal to release position. Repeat this procedure until solid fluid, free from bubbles comes from the bleed screw, checking the master cylinder reservoir frequently to insure an ample supply of fluid. Using this method, bleed No. 1 and No. 2 bleed screws on the Hydrovac and then proceed to the vehicle wheel cylinders.

Pressure Bleeding

(CAUTION: This operation must be done with the engine *OFF* and no vacuum in the power brake system.) Make certain there is sufficient brake fluid in the bleeder tank before starting and that the pressure is from 10 to 30 pounds per square inch. With bleeder tank prepared, fill master cylinder reservoir before attaching hose from bleeder tank to the reservoir. With the pressure from the bleeder tank applied to the master cylinder, bleed the *Hydrovac first*, starting with the bleed screw on the control valve (Bleed Screw No. 1). When a solid stream of fluid, free from bubbles is obtained, close bleed screw securely and then bleed the Hydrovac hydraulic cylinder (Bleed Screw No. 2). Finally, proceed to the vehicle wheel cylinders and bleed in the order recommended by the vehicle manufacturer.

IDENTIFICATION CHART

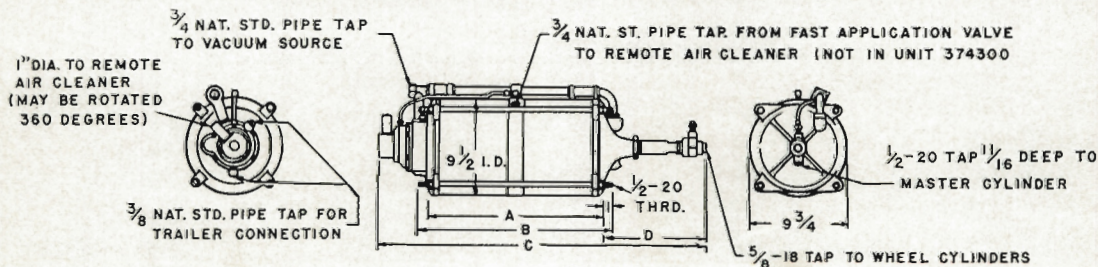
SINGLE PISTON HYDROVACS FOR USE WITH ALL MASTER CYLINDERS UP TO AND INCLUDING 1-3/4" X 1-7/16" BORE AND STROKE



Model of Hydrovac	Hydrovac Part Number	Hydrovac Repair Kit Part No.	Hydrovac Piston Packing Kit No.	Hydrovac Poppet Replacement Kit No.	DIMENSIONAL DATA						
					A	B	C	D	E	F	G
Tonner	375100	375118	374515	374310	6-3/4	4-7/16	4-15/16	10-7/8	5/16-24	5/16-24	3/8" Pipe
Special	374550	374982	374515	374310	6-3/4	4-7/16	4-15/16	10-7/8	5/16-24	5/16-24	3/8" Pipe
Standard	374000	374981	374515	374310	6-3/4	6-11/32	6-3/4	14-5/8	5/16-24	5/16-24	3/8" Pipe
Super	374980*	374320	374510	374310	9-1/2	7-5/16	8-3/8	17-1/4	3/8-24	3/8-24	1/2" Pipe
Super	373853*	374320	374510	374310	9-1/2	7-5/16	8-3/8	17-1/4	3/8-24	3/8-24	1/2" Pipe
+Atlas	374750*	374999	374510	375117	9-1/2	10-1/64	10-19/64	21-47/64	3/8-24	3/8-24	1/2" Pipe

NOTE: *Hydrovac 374750, 374980, 373853, contains residual line pressure check valve and must be used with a master cylinder that does not include a residual line pressure check valve.

TANDEM PISTON HYDROVACS FOR USE WITH 1-3/4" MASTER CYLINDER USING 1-7/8" to 2-1/2" STROKE



Model of Hydrovac	Hydrovac Part Number	Hydrovac Repair Kit Part No.	Hydrovac Piston Packing Kit No.	Hydrovac Poppet Replacement Kit No.	DIMENSIONAL DATA				REMARKS
					A	B	C	D	
+Atlas	374300	374508	374562	375116	14-3/4	16-3/4	26-5/8	7-51/64	Fast Application Valve in Center Plate Fast Application Valve in Center Plate
Mogul	374229	374506	374562	375116	17	19	29-15/16	8-51/64	
Dread-naught	374230	374507	374562	375116	20-3/4	22-3/4	35-3/4	10-5/8	

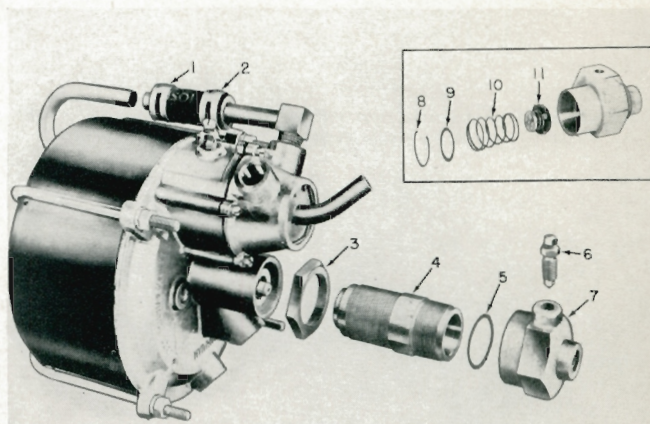
These Hydrovacs to be used with a master cylinder that does not include a residual line pressure check valve.

+ Current design Atlas is single piston type, early design Atlas was tandem piston type.

BENCH OVERHAUL OF MODEL C HYDROVAC

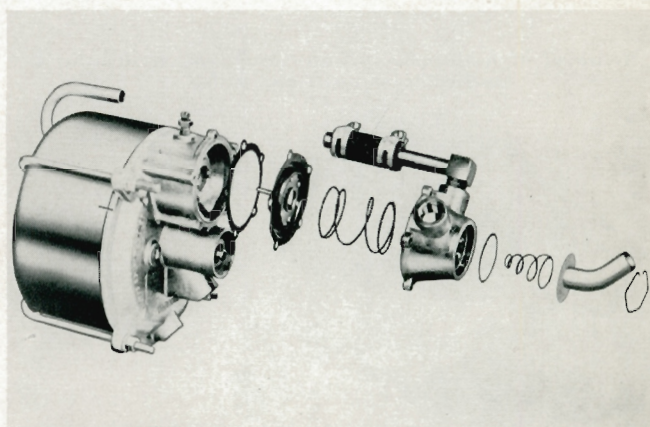
Disassembly of Single Piston Types

1 Loosen the hose clamps (1) and (2) and slide the hose off of the cylinder tube as shown. Loosen the lock nut (3) and unscrew the hydraulic cylinder (4) from the end plate. Hold the end cap (7) in a vise, and unscrew the hydraulic cylinder, using an open-end wrench on the flat part of the cylinder. Remove gasket (5) and bleed screw (6) from the end cap. If the unit has a residual line pressure check valve (11), remove this valve by taking out snap ring (8), washer (9), and spring (10).



1 Disassembly of hydraulic cylinder. Inset shows end cap with residual line pressure check valve.

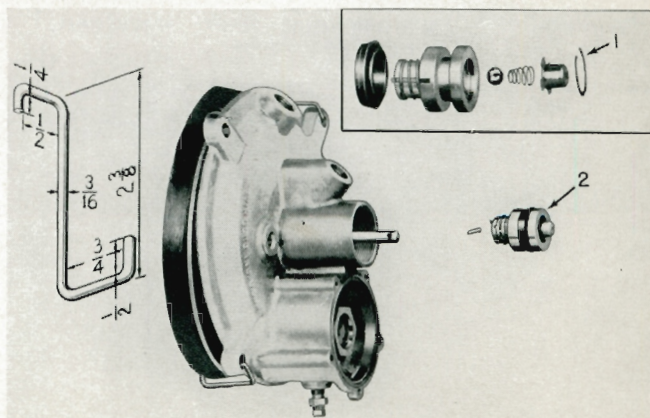
2 Remove the control valve housing and valve parts, as illustrated. Scribe a line across the cylinder shell and end plate, so these can be reassembled in their original position. Remove the hook bolts, and then remove the cylinder shell.



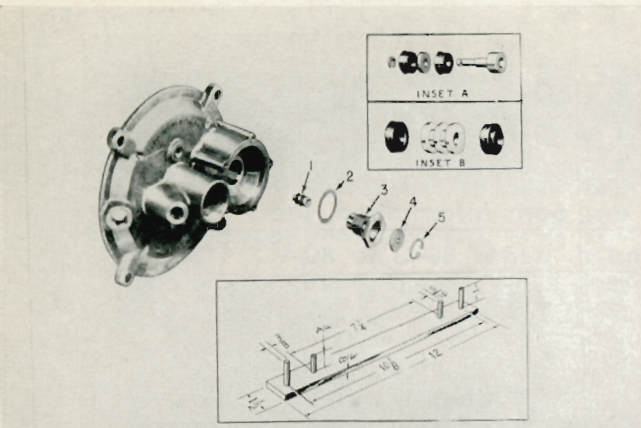
2 Disassembly of vacuum control valve.

3 Compress the piston return spring by pressing down on the end plate, and install the hook clamps as illustrated. The dimensional sketch shows how to make these clamps. Remove the hydraulic piston (2) from the push-rod by sliding snap ring or retainer spring back and removing pin. Remove the hook clamps, which will allow the vacuum piston and spring to come out.

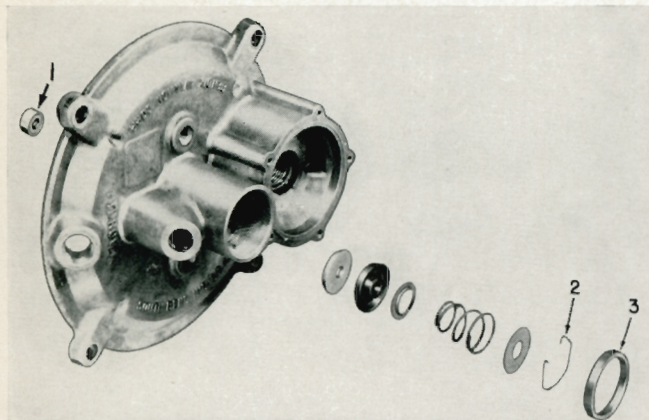
If the vacuum piston leather or any other part of the piston is damaged, disassemble the piston. (Piston parts are illustrated in picture number 3, page 5, of Reassembly Section.) Disassemble the hydraulic piston by first removing the snap ring (1), then disassemble the spring cup, spring, and ball as shown in the inset illustration at upper right.



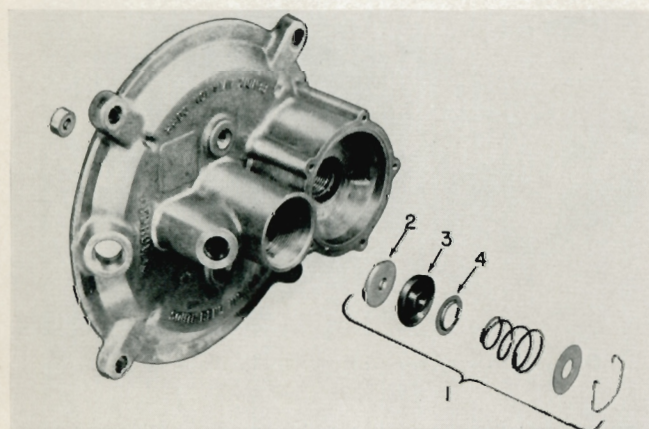
3 Removal of hydraulic piston from push-rod. Inset shows disassembly of hydraulic piston.



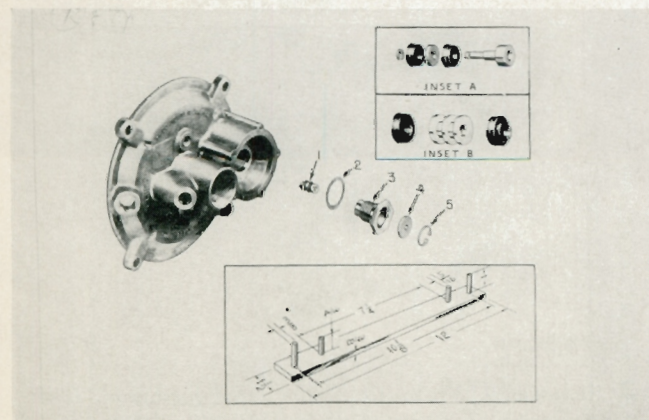
Removal of hydraulic control valve piston assembly. **4**
Inset shows types of pistons.



Removal of hydraulic cylinder end seal, hydraulic and vacuum push-rod seals. **5**



Installing guide washer, hydraulic push-rod seal and piston stop washer. **1**



Assembly of hydraulic control valve piston. **2**
Inset shows types of pistons.

4 Place the end plate over the pins of the end plate holding fixture (see inset lower right for details of holding fixture). Clamp the fixture in a vise. Remove retainer ring (5) using special tool T-25279 and stop washer (4). Using 1-1/8" socket wrench, remove hydraulic valve piston fitting (3). Press out valve piston (1) and remove cups from the valve piston, as illustrated upper right. Inset "A" type piston used in 6-3/4" (single piston) Hydrovacs. Inset "B" type piston used in 9-1/2" (single piston) Hydrovacs.

5 Remove the hydraulic cylinder end-seal (3). Remove the snap-ring (2) and then remove push-rod seal cup parts as illustrated. Lift the end plate from the fixture and place it upon two wooden blocks; drive out the push-rod leather seal assembly (1) using a flat-end rod or drift.

Disassembly is now complete.

ASSEMBLY OF SINGLE PISTON TYPES

Thoroughly clean all metal parts in a parts cleaner such as Bendix Metalcene. After cleaning, wash all hydraulic system parts in clean alcohol before assembly. Always use a Hydrovac repair kit when overhauling a Hydrovac. For correct Hydrovac repair kit to use and complete list of service parts and other repair kits, see Bendix BK Parts Catalog 9E, Section II.

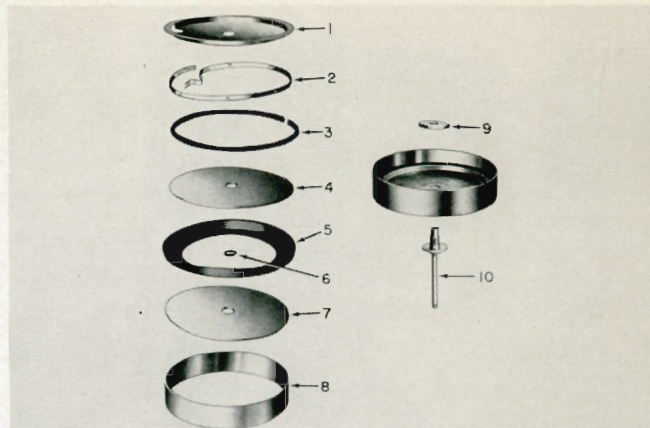
Inspect all parts for excessive wear or damage, replace worn or damaged parts. If the bore of the vacuum cylinder shell is corroded or rusted, polish with fine emery cloth or steel wool. If badly pitted or scored, replace cylinder shell. Inspect condition of control valve seat and poppets. If seat is damaged, replace control valve. If seat is not damaged but one or both poppets are damaged, use poppet valve replacement kit.

1 Press push-rod leather seal into end plate with lip of leather seal toward hydraulic cylinder side of end plate. Place end plate on bench and assemble push-rod hydraulic seal parts (1) as illustrated, stop washer (2) with chamfered side down; seal cup (3) with lip of cup up; retainer washer (4) with flat side next to cup; small end of spring down. Place stop washer against spring and assemble snap ring in groove.

2 Assemble the stop washer (4) and retainer ring (5) using special tool T-25279. Dip piston cups in brake fluid and assemble on piston (1). (Note: see inset of picture 2 for position of cups.) Inset "A" type piston used in 6-3/4" (single piston) Hydrovacs. Inset "B" type piston used in 9-1/2" (single piston) Hydrovacs. Insert piston (1) into fitting (3) with the hole end of piston (1) next to stop washer (4). Place end plate on end plate holding fixture. (Use new copper gasket (2) on Hydraulic fitting (3) without groove. Use new rubber seal gasket (2), Part No. 374915 on hydraulic fitting (3) with groove.) Assemble fitting (3) into end plate and securely tighten with a 1-1/8" socket wrench. When copper gasket (2) is used, fitting (3) should be tightened using 1100 to 1300 inch lbs. of Torque.

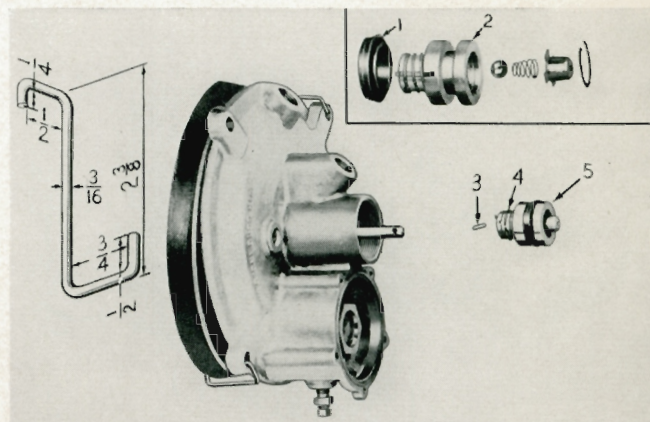
3 If the vacuum piston has been disassembled to replace the leather piston packing or other parts reassemble the piston and push-rod as illustrated.

Drill 5/16" hole in bench and place push-rod (10) in hole with threaded end up. Assemble piston parts as follows: Flat washer over threaded end of push-rod; larger diameter piston plate (7) with chamfered side of hole up; guide rubber seal ring (6) over threads. Place assembly ring (8) of correct size (SER-432 or SER-434) over piston plate and assemble following parts: Leather packing (5) with lip of packing up; smaller diameter piston plate (4) with chamfered side of hole down. Cut cotton wicking (3) to required length and assemble against inner face of lip of leather Packing; assemble expander ring (2) inside of cotton wicking with gripper points up and notch at loop end of expander ring under clip located near the opposite end of the expander ring; retainer plate (1) with cut-out portion over loop of expander ring; thread nut (9) onto push-rod finger tight. Clamp hexagonal section of push-rod in vise and securely tighten nut. Care must be taken to prevent retainer plate from shifting while tightening the nut. Stake the nut at two places.



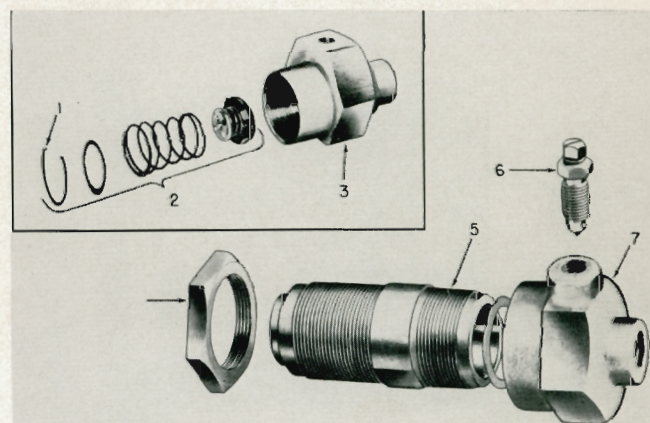
3 Assembly of vacuum piston and push-rod.

4 Place vacuum piston return spring over push-rod with small end of spring next to vacuum piston and carefully guide push-rod through leather seal in end plate. Use hook clamps to hold end plate and piston together. Wash hydraulic cylinder piston parts in alcohol and assemble parts as illustrated in inset upper right. Dip hydraulic piston cup (1) in brake fluid before assembly. Note: Lip of piston cup extends toward check valve end of piston. Attach hydraulic piston (5) to push-rod by means of retainer pin (3). Slide snap ring (4) or pin retaining spring (2) over hole in piston to hold retainer pin in place.



4 Assembly of vacuum piston, piston return spring, end-plate and hydraulic piston.

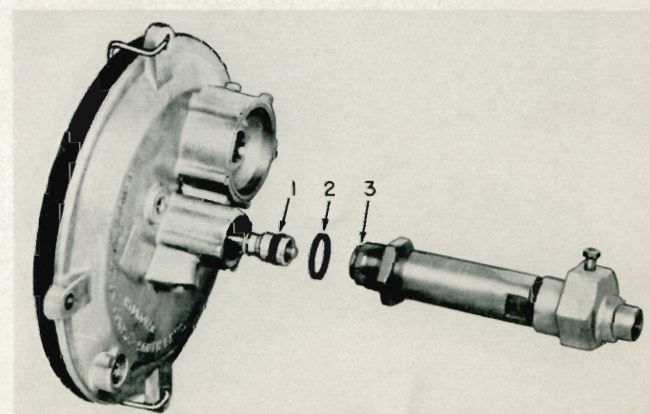
5 If inspection reveals that the hydraulic cylinder tube (5) is rusted or scored, replace using late type hydraulic cylinder tube (design having groove for check nut seal). For correct hydraulic cylinder check nut and seal to use with hydraulic cylinder tube, see 9E Catalog, Section II. If Hydrovac incorporates residual line pressure check valve, assemble check valve parts (2) in end cap (3) as illustrated in inset. NOTE: A special snap ring installation tool, T-25277, is available for installing snap ring (1). Place new copper gasket in end cap (7) and thread hydraulic cylinder tube (5) into end cap with milled flats next to end cap. Hold end cap in vise and securely tighten cylinder in end cap. Assemble bleed screw (6) and thread check nut (4) on cylinder to limit of threads.



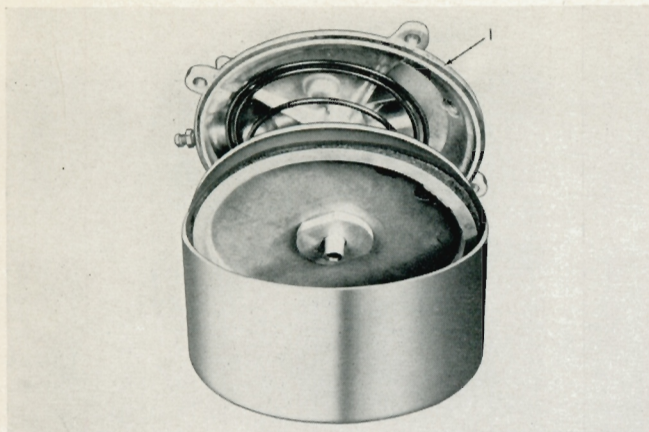
5 Assembly of hydraulic cylinder and end cap. Inset shows end cap with residual pressure check valve.

6 Place hydraulic cylinder end seal (2) in end plate against shoulder. On early type hydrovacs (without check nut seal) identified by the thin check nut, assemble one seal ring 374915 over the threads of the hydraulic cylinder tube next to the check nut. On late type Hydrovacs (with check nut seal) identified, by the thick check nut, assemble check nut seal in groove on hydraulic cylinder. Guide the lip of the piston cup (1) into the bore of the cylinder and then thread the cylinder in by hand until end of the cylinder bottoms firmly against the end seal.

Do not tighten cylinder check nut at this time.



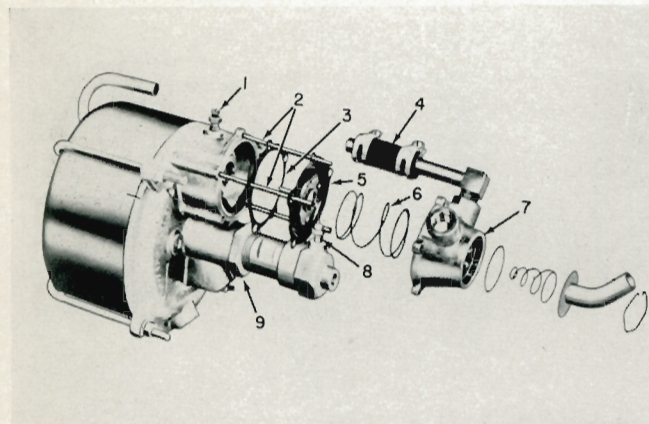
6 Assembly of hydraulic cylinder into end plate.



Assembly of vacuum piston into cylinder shell.

7

7 Place gasket (1) on end plate. The rubber ring gasket furnished in the repair kit is for use with Hydrovacs having a gasket retaining groove in the end plate; if the end plate is not grooved, use Vellumoid gasket B-K 16738 on 6-3/4" cylinders, or Vellumoid gasket B-K 3143 on 9-1/2" cylinders. Saturate the cotton wicking by dipping vacuum cylinder piston packing in Bendix Vacuum Cylinder Oil (do not use ordinary engine oil). Allow sufficient time for excess oil to drain off. Coat inside of cylinder shell lightly with Bendix Vacuum Cylinder Oil. Insert piston into cylinder by tipping piston as illustrated. Line up end plate with scribed marks previously made in step 2 of disassembly (page 3). Attach hook bolts, and tighten each bolt evenly, until all bolts are uniformly tight.



Assembly of diaphragm, control valve housing, and air cleaner tube.

8

8 If it was found necessary to replace the vacuum and atmospheric poppets use poppet replacement kit. For correct poppet kit to use see Bendix Parts Catalog 9-E, Section II. For removal and replacement of the poppets in all single piston Hydrovac except 374750 Atlas, see instruction sheet, form 9-591, enclosed in poppet replacement kit 374310.

For disassembly or reassembly of the poppets in 374750 Atlas Hydrovac, see figure 10, page 11.

Place guide pins (2) in end plate (as shown) and carefully assemble control valve parts as illustrated. Guide pins can be made by cutting the heads off of No. 8-32 x 2-1/2" machine screws. Remove guide pins one at a time and replace with a screw and lock-washer. When assembling the diaphragm (5), return spring (6) and control valve body (7), extreme care should be taken not to distort the diaphragm in compressing the spring.

Assemble vacuum hose (4) in place and tighten clamps.

Tighten hydraulic cylinder to align the bleed screw (8) in the end cap with the bleed screw (1) in the end plate.

Tighten lock nut (9) securely.

Inspect Hydrovac to see that all bolts, nuts, washers, and screws are in place and all tubes, clamps and fittings are securely tightened. After overhaul, vacuum and hydraulic leakage and operation tests should be made. For complete test procedure on all Hydrovacs, see Test Manual Form No. 9-355.

THE HYDROVAC ANALYZER

After assembly has been completed the overhauled unit should be bench-tested before it is installed on the vehicle. The Hydrovac Analyzer illustrated at the left has been developed by the Bendix Factory for this purpose. Testing consists of checking all the operating functions. Developed hydraulic pressures are compared with factory standards for the Hydrovac in question. A complete test manual is furnished with each Analyzer.

DISASSEMBLY OF TANDEM PISTON HYDROVACS

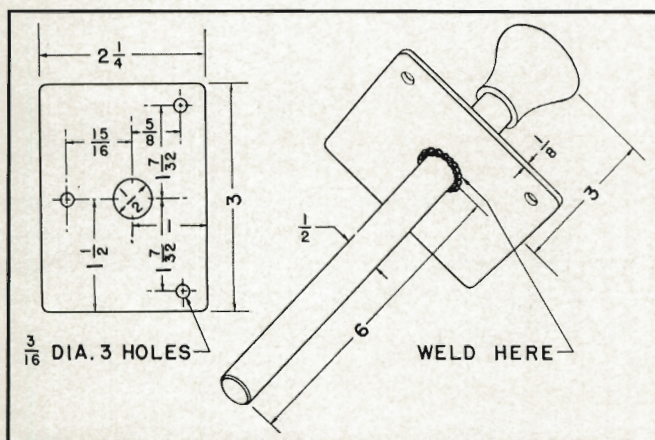
For exploded view with parts keyed and parts information, see Bendix B-K Parts Catalog 9-E, Section II.

1 Remove the control valve cover and valve parts (1), as illustrated. Hydrovacs 374229 and 374230 have a vacuum by-pass tube which must be removed before the valve housing can be taken off. The inset illustration shows removal of control valve poppets.

2 Force the vacuum cylinder pistons forward by inserting the special return spring compression tool (1) through the opening in the end plate. Attach flange (2) of tool to end plate using three of the valve-cover screws. Details for making the special tool are shown in illustration 2A.

Loosen hydraulic cylinder check nut and remove the hydraulic cylinder (8). Remove hydraulic piston (7) from the push-rod by sliding the snap ring (6) or push-rod pin retaining spring back on piston, then remove retainer pin (10). Hold the end cap (9) in a vise and remove hydraulic cylinder (8). Disassemble the residual line pressure check valve parts (4). Loosen the vacuum hose clamps (3) and slide both hoses toward center of vacuum tube. Remove the hydraulic by-pass tube (opposite side of Hydrovac from that illustrated).

Remove the return spring compression tool.

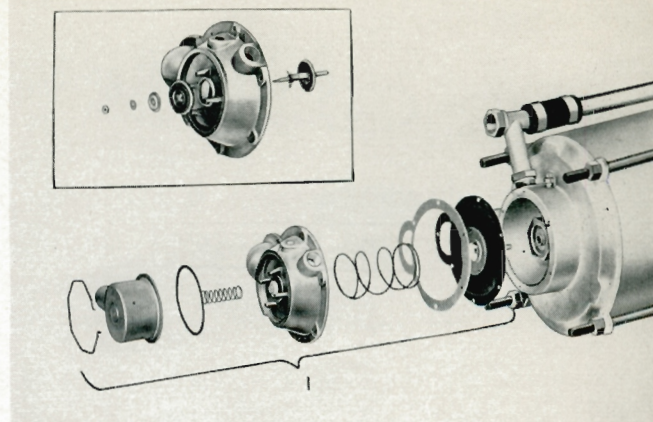


2A Vacuum piston return spring compression tool.

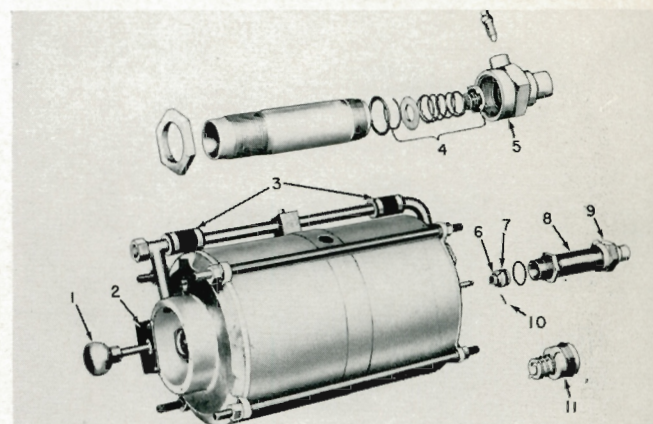
3 Remove the four cylinder studs (6) and disassemble end plates (1) and (4), cylinder shells (2) and (3), and center plate assembly (5) as illustrated.

4 Compress piston return spring by forcing the center plate and vacuum piston (1) together, and insert a rod (2) through hole in piston rod to hold spring compressed as illustrated. Place assembly ring SER-434 over piston (5) and remove the piston rod nut (7), push-rod pin (3) and push-rod (6). Lift off the piston assembly, keeping the piston parts assembled within the assembly ring.

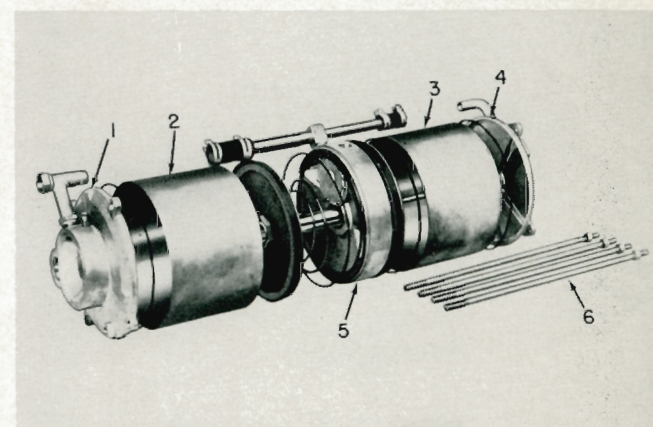
Remove piston rod nut (4), press down on center plate to remove rod (2). Then remove center plate and piston return spring from piston and piston rod assembly (1).



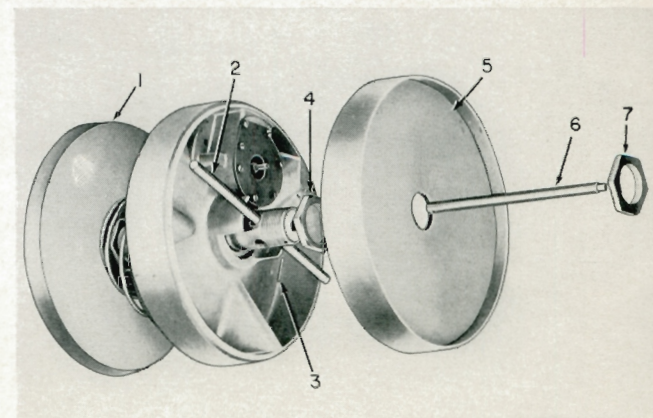
1 Disassembly of vacuum control valve and poppets.



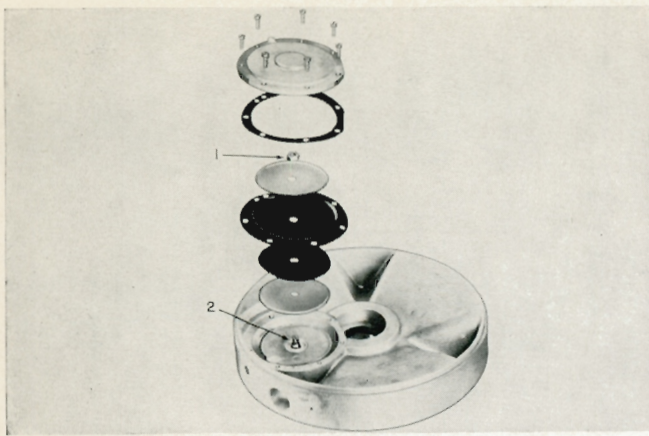
2 Removal of hydraulic cylinder and hydraulic piston.
Note: No. 11 shows piston with spring type retainer.



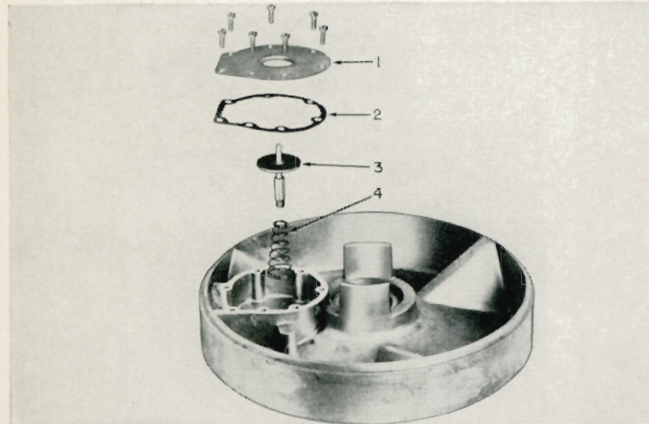
3 Removal of cylinder studs, end plates, cylinder shells, center plate and pistons.



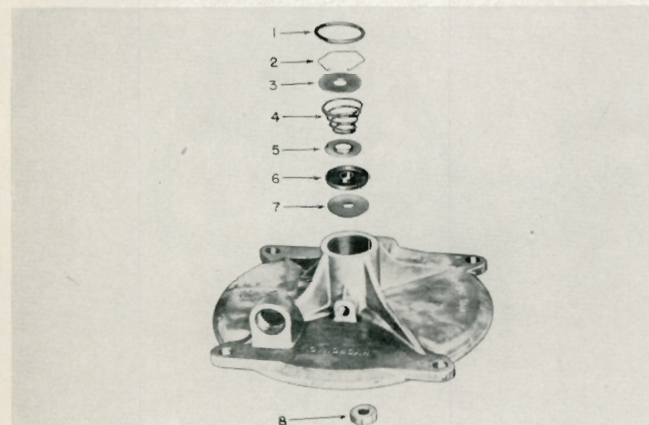
4 Disassembly of push-rod, vacuum pistons and center plate.



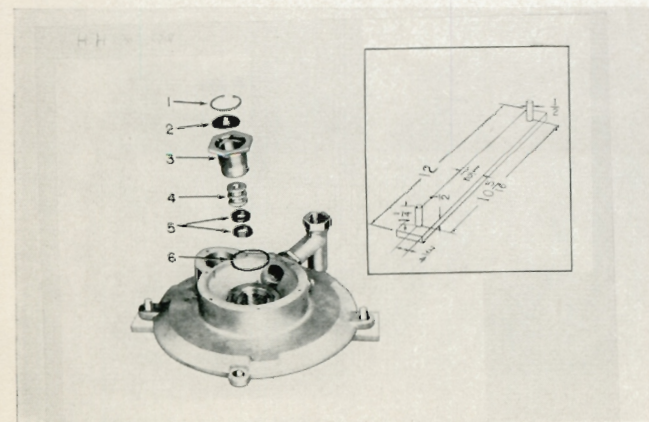
5 Disassembly of fast application valve cover and diaphragm assembly.



6 Disassembly of fast application valve seat and poppet.



7 Disassembly of hydraulic cylinder end seal, hydraulic and vacuum push-rod seals.



8 Disassembly of hydraulic control valve fitting and piston.

5 Note: This operation and No. 6 below apply only to Hydrovacs 374229 and 374230 which have the fast-application valve in the center plate.

Remove fast-application valve cover. To disassemble diaphragm assembly, hold the valve shaft (2) with a screw driver in the slot provided, when loosening the nut (1), and disassemble diaphragm parts as illustrated.

6 Turn the center plate over and remove valve seat plate (1), gasket (2), poppet valve (3), and spring (4).

7 Place front end plate assembly on bench, flat side down, and remove "O" ring seal (1), snap ring (2), retainer washer (3), push-rod seal spring (4), flange washer (5), push-rod rubber cup seal (6), and guide washer (7). Drive out push-rod leather seal (8).

8 Place end plate over pins of holding fixture; (details for making this fixture are shown in inset). With holding fixture clamped in vise, remove retainer ring (1), using special tool T-25254, and remove stop washer (2). Using 1-7/8" socket wrench, remove hydraulic valve fitting (3), push out hydraulic piston (4), and remove piston cups (5). Remove gasket (6) from fitting.

Disassembly is now complete.

ASSEMBLY OF TAMDEM PISTON TYPES

Thoroughly clean all metal parts in a parts cleaner such as Bendix Metalclene. After cleaning, wash all hydraulic system parts in clean alcohol before assembly. Always use a Hydrovac repair kit when overhauling a Hydrovac. For correct Hyrdovac repair kit to use and complete list of service parts and other repair kits, see Bendix BK Parts Catalog 9E, Section II.

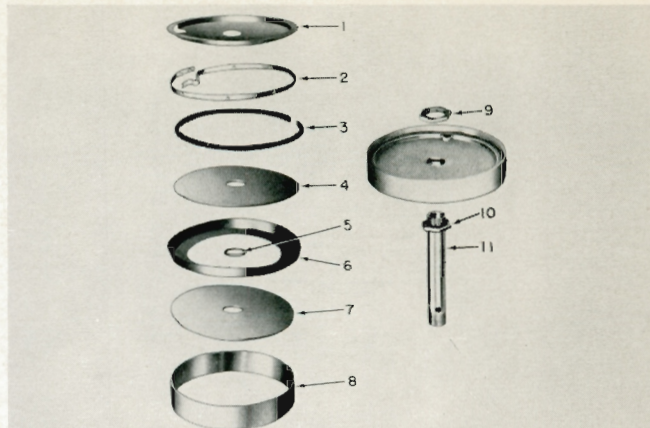
Inspect bore of cylinder shell. If corroded or rusted, polish with fine emery cloth or steel wool. If badly pitted or scored, replace.

1 Inspect type of wick used on rear vacuum piston. If felt type of wick is used, disassemble vacuum piston and replace felt type of wick with cotton type of wick, part No. 372995, and reassemble piston as illustrated. Thread nut (10) onto piston rod (11) with flat side of nut up. Assemble larger diameter piston plate (7) on piston rod with chamfered side of hole up. Guide rubber seal ring (5) over threads of piston rod. Place assembly ring SER-434 on bench and assemble balance of piston parts as follows: Leather packing (6) (lip side up), smaller diameter piston plate (4) (chamfered side of hole down). Cut wick (3) to required length and assemble against inner face of lip of leather packing. Assemble expander spring (2) against wick with gripper points up and hook notched end of spring under clip near opposite end of spring. Place cut out of retainer plate (1) over loop of spring. Hold piston parts in assembly ring and assemble over piston rod. Thread nut (9) onto piston rod until flush with end of piston rod. Stake nut securely at two places. Clamp staked nut (9) in vise and securely tighten nut (10) against piston plate.

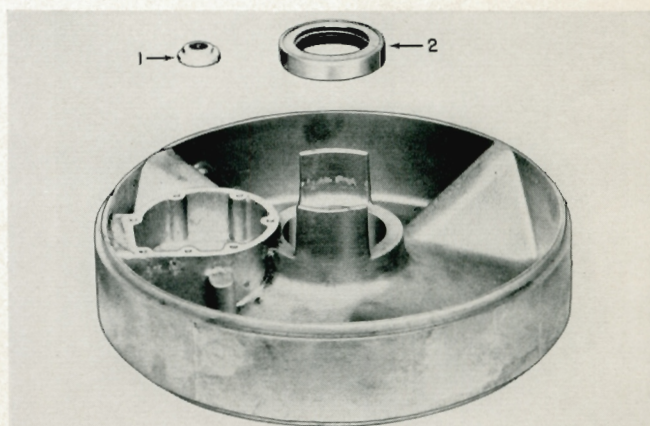
2 Press the leather seals (1) and (2) into place in the center plate, seal (1) should be flush with the bottom of the hole, seal (2) should rest against the shoulder in the center plate. On Hydrovac 374300 (without fast-application valve) seal (1) is not used, and seal (2) should be pressed into center plate until flush with the bottom of the hole.

3 Assemble fast-application valve poppet assembly, into center plate as illustrated. Be sure the small end of the return spring (4) is up. Place bullet nose tool (3) (Part No. T25265) on poppet valve shaft at threaded end to prevent the shoulder on the valve shaft from damaging leather seal when assembling the shaft. Install gasket, valve seat plate (1) with seat side down and replace screws and lockwashers.

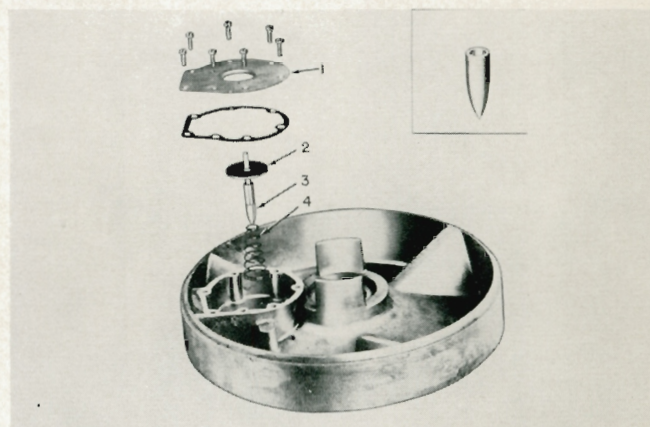
4 Turn the center plate over and assemble the diaphragm parts as illustrated. Note the following: Rounded edge of the diaphragm plate (7) is up; place diaphragm gasket (6) on plate; assemble diaphragm (5) so that screw holes and by-pass hole register with screw holes and by-pass hole in center plate (8); rounded edge of diaphragm plate (4) is down. Assemble nut (3), hold the valve shaft with a screw driver as nut (3) is tightened; stake nut securely at two places. Assemble cover gasket (2) and cover plate (1) with screws and lockwashers.



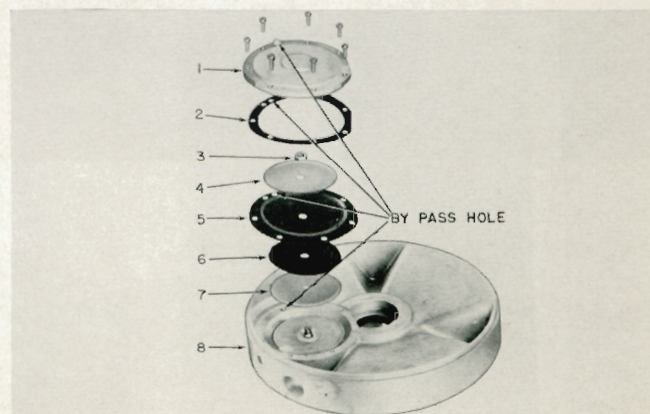
1 Assembly of vacuum piston and piston rod.



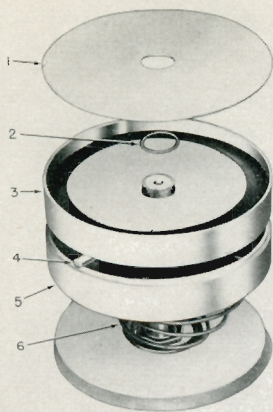
2 Installing fast application valve and piston rod seals in center plate.



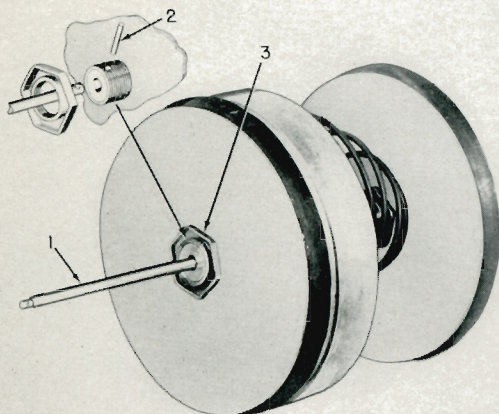
3 Assembly of fast application valve poppet and seat.



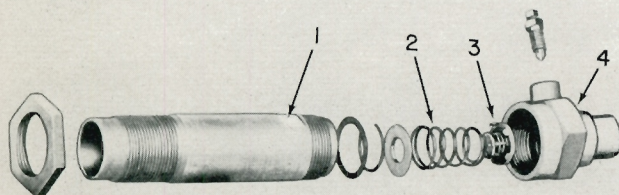
4 Assembly of fast application valve diaphragm and cover.



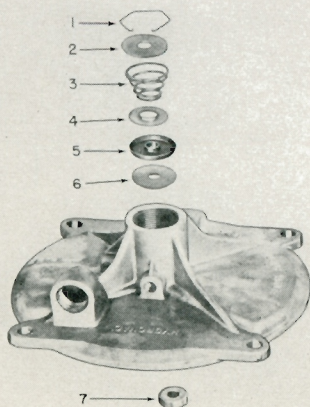
*Assembly of rear vacuum piston, piston return spring **5** and center plate.*



*Assembly of front vacuum piston and push-rod. **6***



*Assembly of residual pressure check valve, hydraulic **7** cylinder and end cap.*



*Assembly of push-rod seals, guide washer, and piston **8** stop washer.*

5 Place the piston return spring (6) over the piston rod with small end of the spring down. Carefully guide the piston rod through the leather seal in the center plate (5), having the piston stop flanges of the center plate up. Press down on center plate and insert rod (4) through hole in piston rod. Thread piston rod nut onto piston rod to the limit of the threads with flat side of nut up (see picture 4 page 7).

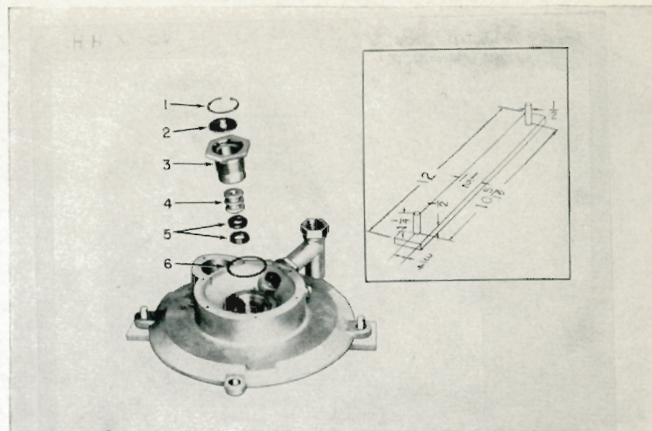
If the forward piston has been disassembled to replace leather piston packing, to install new type cotton wicking or other parts, reassemble piston parts in assembly ring as illustrated in picture 1 on page 9. Hold piston parts in assembly ring and turn assembly ring over. Remove outer or larger diameter piston plate (1) and "O" ring seal (2). With assembly ring (3) still in place guide remaining piston parts over end of piston rod up against piston nut. Carefully guide "O" ring seal (2) over threads of piston rod and assemble larger diameter piston plate (1) over piston rod with chamfered side of hole down.

6 Assemble large end of push-rod (1) in end of piston rod and replace retainer pin (2) as illustrated. Thread piston rod nut (3) onto piston rod with flat side down until nut is flush with end of piston rod. Stake nut securely at two places. Hold piston rod nut (3) in vise or with wrench and tighten inner nut securely against piston. Care must be taken when tightening nut to prevent expander spring retainer plate from shifting. Remove the assembly ring and then remove the rod which was used to hold the return spring compressed during operations 5 and 6.

7 Hold the end cap (4) in a vise and assemble the parts as illustrated. Note the following: The small end of the spring (2) must be placed inside the clips of check valve (3). A special snap ring installation tool, T-25277 is available for installing the snap ring. Install new copper gasket in end cap. The hydraulic cylinder should be assembled with the milled flats next to the end cap. Securely tighten hydraulic cylinder in end cap. Thread the check nut on the hydraulic cylinder up to limit of threads. On late type units having check nut seal install check nut seal 375042 in groove of hydraulic cylinder tube. Replace bleed screw in end cap.

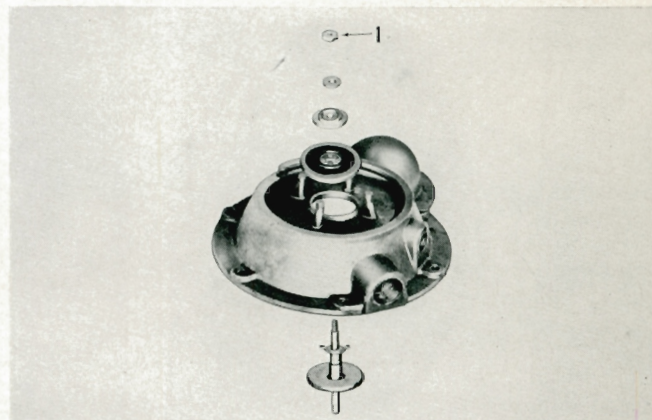
8 Press the push-rod leather seal (7) into the front end plate (from side opposite to that shown in the picture); the lip of the leather seal should be toward the hydraulic cylinder end of end plate. Assemble the push-rod hydraulic seal parts as illustrated. Note the following: Chamfered side of stop washer (6) is down; lip of cup (5) is up; flat side of washer (4) is next to cup; the small end of spring (3) is down. Place washer (2) against spring. Install snap ring (1) into second (inner) groove of end plate.

9 Assemble the stop washer (2) with flat side into fitting (3) and retainer ring (1) using special tool T-25254. Dip piston cups (5) in brake fluid and assemble on piston (4) with the lips of cups away from each other. Insert piston (4) into fitting (3) with the hole end of piston (4) next to stop washer (2). Place end plate on end plate holding fixture. (Use new copper gasket (6) on hydraulic fitting (3), without groove. Use new rubber seal gasket (6) Part No. 374914 on hydraulic fitting (3) with groove.) Securely tighten fitting into the end plate with a 1-7/8" socket wrench. Where copper gasket (6) is used, fitting (3) should be tightened to approximately 4000 inch lbs. of torque.



9 Assembly of hydraulic control valve fitting and piston.

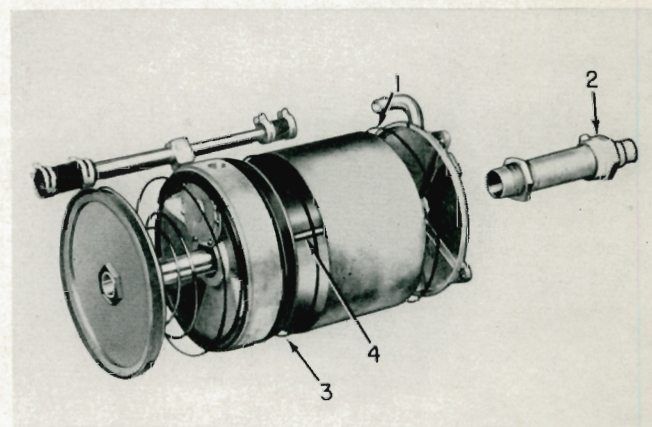
10 Assemble poppet valves and related parts into control valve housing as illustrated. Stake nut (1), at two places after assembly. If poppet valves are disassembled always replace lead washer part No. 374366.



10 Assembly of vacuum control valve poppets.

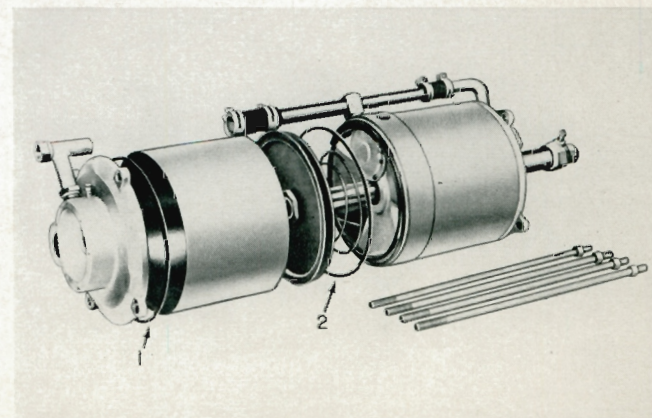
11 Hold the hydraulic cylinder end cap (2) in a vise and assemble parts as illustrated. Thread the hydraulic cylinder into front end plate. (End plate nearest to hydraulic cylinder.)

Place gasket (1) on ledge of end plate, then place cylinder shell in position; coat inside of cylinder shell with vacuum cylinder oil, saturate cotton wicking by dipping vacuum cylinder piston packings in Bendix Vacuum Cylinder Oil. Allow sufficient time for excess oil to drain off; place gasket (3) on ledge of center plate; guide push-rod (4) carefully through seal in front end plate. Align vacuum tube on center plate with vacuum tube on front end plate.

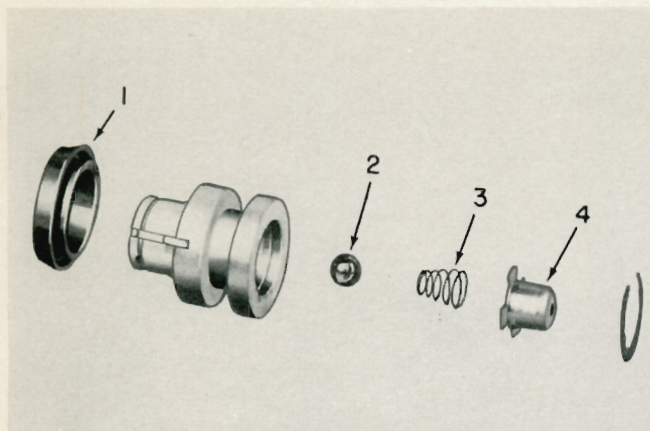


11 Assembly of hydraulic cylinder, front end plate, front cylinder shell, center plate and pistons.

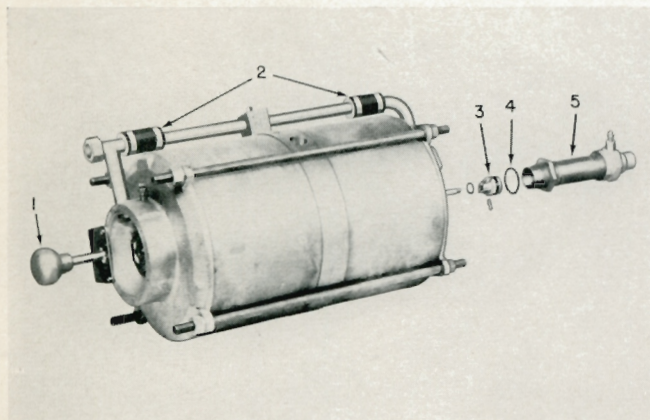
12 Assemble rear cylinder shell and related parts as illustrated. Assemble gasket (2) on center plate. Coat inside of cylinder shell with vacuum cylinder oil; tip the cylinder shell to about 45° to prevent damage to leather packing and assemble in position. Place gasket (1) on ledge of rear end plate; align and assemble rear end plate. Install cylinder studs and tighten the studs evenly.



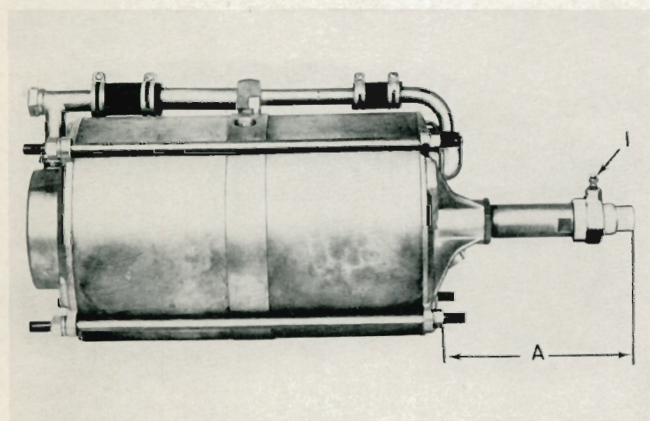
12 Assembly of rear cylinder shell, end plate and cylinder studs.



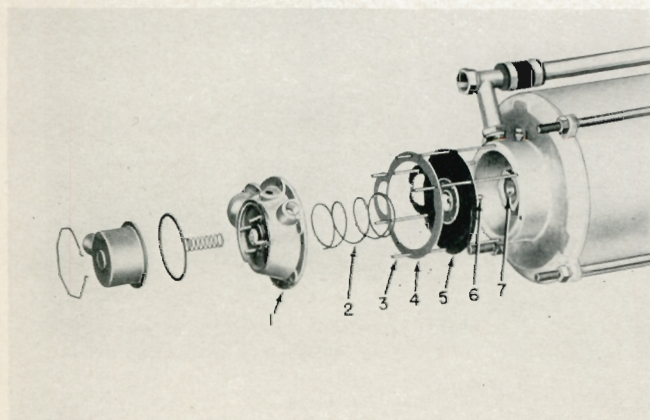
Assembly of hydraulic piston check valve and piston cup. **13**



Assembly of hydraulic piston and hydraulic cylinder assembly. **14**



Cylinder stud to hydraulic cylinder end measurement. **15**



Assembly of vacuum control valve diaphragm, valve housing, and air cleaner cover. **16**

13 Assemble the hydraulic piston parts as illustrated. Note the following: Large end of spring (3), goes in retainer cup (4); lip of piston cup (1) extends toward check valve ball (2); dip the piston cup (1) in hydraulic fluid before assembling.

14 Assemble vacuum hose (2) and hydraulic by-pass tube (on opposite side of Hydrovac from that shown). Remove the hydraulic cylinder (5) and insert spring compressing tool (1) (see operation 2, page 7); attach flange of spring compressing tool with three screws. Assemble hydraulic piston (3) to push-rod as illustrated, being careful that lock ring or retaining spring is in position over retainer pin. Assemble hydraulic cylinder end seal (4) in groove of end plate. Carefully guide hydraulic cylinder over piston cup to prevent damage to the piston cup.

15 Thread hydraulic cylinder into end plate and adjust to dimension "A", see table below. Align bleed screw in end cap with bleed screw in control valve. Remove spring compressing tool. NOTE: To form a check nut seal on early type Hydrovacs (without check nut seal groove in the hydraulic cylinder tube), use 1/2 of Gasket 374552 as a seal. Back off on check nut three to four turns. Dip gasket in hydraulic brake fluid and make two loose wraps of the gasket between the end plate and check nut. Hold ends of gasket and securely tighten check nut. Cut off ends of gasket.

Model of Hydrovac	Hydrovac Part Number	Dimension "A"	
Atlas.....	374300	7-51/64"	} Plus or } Minus } 1/2 Turn
Mogul.....	374229	8-51/64"	
Dreadnaught.....	374230	10- 5/8"	

16 Place guide pins (3) in end plate (as shown) and carefully assemble parts as illustrated. These guide pins may be made by cutting off heads of No. 8-32 x 2-1/2" machine screws. Remove guide pins, one at a time and replace with a screw and lockwasher. When assembling diaphragm (5), diaphragm gasket (4) return spring (2) and control valve body (1), extreme care should be taken not to distort the diaphragm in compressing the spring (2). Diaphragm stem (6) fits into hole of hydraulic control piston (7). If the Hydrovac being repaired is either a 374229 or a 374230 replace the fast-application valve vacuum control tube.

Inspect Hydrovac to see that all bolts, nuts, washers, and screws are in place and all tubes, clamps and fittings are securely tightened. After overhaul, vacuum and hydraulic leakage and operation tests should be made. For complete Test procedure on all Hydrovacs, see Test Manual Form No. 9-355.

LUBRICATION OF MODEL C HYDROVACS

CAUTION: Do not lubricate the Hydrovac until it has been permanently installed on the vehicle. This is a safeguard against lubricating oil entering the hydraulic portion of the Hydrovac which might cause damage to the rubber cups and seals.

The Hydrovac is to be lubricated with the engine off and the brakes released. Use Bendix Vacuum Cylinder Oil for lubrication.

WHEN TO LUBRICATE—QUANTITY TO USE

The 6-3/4" diameter single piston Hydrovac should be lubricated every 20,000 miles or once a year whichever occurs first.

The 9-1/2" diameter single piston Hydrovac should be lubricated every 10,000 miles or every six months whichever occurs first.

The 9-1/2" diameter tandem piston Hydrovacs should be lubricated every 20,000 miles or once a year whichever occurs first.

Use 1 oz. in all 6-3/4" single piston Hydrovacs.

Use 2 oz. in all 9-1/2" single piston Hydrovacs.

Use 2 oz. in both front and rear chambers of all tandem piston Hydrovacs.

HOW TO LUBRICATE

Single Piston Hydrovacs

*With Lubrication Plug.
See Fig. 1*

To lubricate Hydrovacs having lubrication plugs, remove the lubrication plug and inject Bendix Vacuum Cylinder Oil through the fitting up to the point where the oil begins to run out of the port, See Figure 1. Replace and tighten pipe plug.

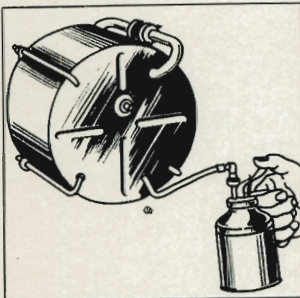


Fig. 1. Single Piston with Lubrication Port

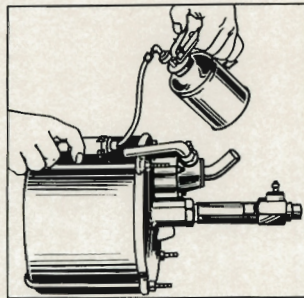


Fig. 2. Single Piston without Lubrication Port.

Single Piston Hydrovacs

*Without Lubrication Plug.
See Fig. 2*

Loosen Hose Clamps and slide hose on the tube connecting control valve with vacuum cylinder shell. Slide hose toward control valve on 6-3/4" diameter Hydrovacs and away from control valve on 9-1/2" diameter Hydrovacs. Using a gun type of oiler (such as used in filling shock absorbers), inject the specified quantity of oil into the Hydrovac. The spout of the oil gun should be inserted well down the bend of the tube to insure that all oil enters the vacuum cylinder, See Figure 2.

Tandem Piston Hydrovacs

*With Lubrication Plugs.
See Fig. 3*

To lubricate tandem piston Hydrovacs with lubrication plugs, remove pipe plugs (1) and (2), See Figure 3, and inject vacuum cylinder oil through each port up to the point where the oil just begins to run out of the port. Replace the pipe plugs and securely tighten plugs.

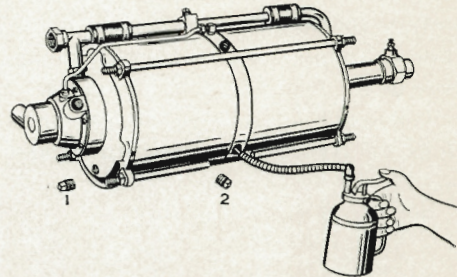


Fig. 3. Tandem Piston with Lubrication Ports.

Tandem Piston Hydrovacs

*Without Lubrication Plugs.
See Figs. 4 and 5*

To lubricate the forward piston of the tandem piston Hydrovacs, remove the vacuum line tube elbow, See Figure 4, and inject two ounces of vacuum cylinder oil into the front cylinder chamber. Replace tube elbow and reconnect vacuum line. *Note:* Extreme care must be taken to insure that the oil *does not* come into contact with the push rod when oil is added.

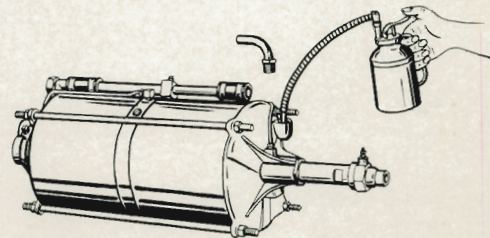


Fig. 4. Tandem Piston without Lubrication Ports.
(lubrication of forward piston)

To lubricate the rear vacuum piston, remove the control valve housing, See Figure 5, after which, two ounces of vacuum cylinder oil should be injected through the passage in the rear end plate. Replace the control valve.

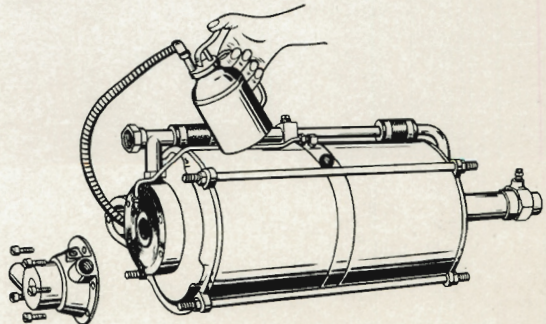


Fig. 5. Tandem Piston without Lubrication Ports.
(lubrication of rear piston)

(Continued on Page 14)

AIR CLEANER SERVICE

The air cleaner should be inspected every 1,000 miles. If air passages are restricted, the air cleaner should be removed, dismantled and thoroughly cleaned in cleaning

solvent and allowed to drip dry. Then saturate hair cleaning element with a light cylinder oil, reassemble and install on the vehicle.

VACUUM CONNECTIONS, FITTINGS, ETC.

Remove the vacuum connection fitting from the intake manifold every 10,000 miles and inspect the fitting and vacuum line or tubing for possible obstructions. Clean out the hole in the manifold, fitting and lines and then reinstall fitting and line. Every 10,000 miles inspect hose fittings at Hydrovac for tightness and inspect

vacuum hose for damage or deterioration due to extreme conditions of operation. Every 10,000 miles or not less than twice a year, a complete test should be made for correct operation of the Hydrovac and for leakage in either the vacuum or hydraulic system.